

An MTU carousel 1656 includes an upper disk 1658 having a central portion 1696. A top surface of the support disk 1694 engages and is attached to a bottom surface of the central portion 1696 of the upper disk 1658 so that the weight of the carousel 1656 is supported from below. As shown in FIGURE 23C, a plurality of radially extending, circumferentially spaced station dividers 1660 are attached beneath the upper disk 1658. A lower disk 1662 includes a plurality of radial flanges 1682 emanating from an annular inner portion 1688. The radial flanges 1682 correspond in number and spacing to the carousel station dividers 1660, and the lower disk 1662 is secured to the bottom surfaces of the carousel station dividers 1660, with each flange 1682 being secured to an associated one of the dividers 1660.

The radial flanges 1682 define a plurality of radial slots 1680 between adjacent pairs of flanges 1682. As can be appreciated from FIGURE 23C, the width in the circumferential direction of each flange 1682 at an inner end 1686 thereof is less than the width in the circumferential direction of the flange 1682 at the outer end 1684 thereof. The tapered shape of the flanges 1682 ensures that the opposite sides of the slots 1680 are generally parallel to one another.

When the lower disk 1662 is attached beneath the carousel station dividers 1660, the widths of the flanges along at least a portion of their respective lengths are greater than the widths of the respective dividers 1660, which may also be tapered from an outer end thereof toward an inner end thereof. The flanges 1684 define lateral shelves along the sides of adjacent pairs of dividers 1660 for supporting the connecting rib structure 164 of an MTU 160 inserted into each MTU station 1663 defined between adjacent pairs of dividers 1660.

A pulley 1664 is secured to the top of the central portion 1696 of the upper disk 1658 and a motor 1672 is carried by a mounting bracket 1670 which spans the diameter of the housing 1650 and is secured to the cylindrical portion 1610 of the housing at opposite ends thereof. The motor is preferably a Vexta PK264-01A stepper motor, and it is coupled to the pulley (having a 9:1 ratio with respect to the motor) by a belt 1666, preferably one supplied by the Gates Rubber Company. A position encoder 1674 is secured to a top central portion of the mounting bracket 1672 and is coupled with the upper shaft 1690 of the carousel support shaft 1654. The encoder 1674 (preferably an absolute encoder of the A2 series by U.S. Digital Corporation of Vancouver, Washington) indicates the rotational position of the carousel 1656.

An incubator cover is defined by an incubator plate 1676, preferably formed of machined aluminum, and a conforming cover insulation element 1678. Cover plate 1676 and insulation

element 1678 include appropriate openings to accommodate the encoder 1674 and the motor 1672 and may also include radial slots formed therein for dispensing fluids into MTUs carried within the incubator as described with regard to the above embodiment.

5 An alternate, and preferred, closure mechanism 1600 is shown in FIGURE 23B. The cylindrical portion 1610 of the incubator housing includes at least one receptacle access opening 1614 with outwardly projecting wall portions 1616, 1618 extending integrally from the cylindrical portion 1610 along opposite sides of the access opening 1614.

10 A rotating door 1620 is operatively mounted with respect to the access opening 1614 by means of a door mounting bracket 1636 attached to the cylindrical portion 1610 of the housing above the access opening 1614. Door 1620 includes an arcuate closure panel 1622 and a transversely extending hinge plate portion 1628 having a hole 1634 for receiving a mounting post (not shown) of the door mounting bracket 1636. The door 1622 is rotatable about the opening 1634 with respect to the access opening 1614 between a first position in which the arcuate closure panel 1622 cooperates with the projecting wall portions 1616, 1618 to close off the access opening 1614 and a second position rotated outwardly with respect to the access opening 1614 to permit movement of a receptacle through the access opening 1614. An inner arcuate surface of the arcuate panel 1622 conforms with an arcuate surface 1638 of the door mounting bracket 1636 and an arcuate surface 1619 disposed below the receptacle access opening 1614 to permit movement of the arcuate panel 1622 with respect to the surfaces 1638 and 1619 while providing a minimum gap between the respective surfaces so as to minimize heat loss therethrough.

15 The door 1620 is actuated by a motor 1642 mounted to the incubator housing by means of a motor mounting bracket 1640 secured to the cylindrical portion 1610 of the housing beneath the receptacle access opening 1614. A motor shaft 1644 is coupled to a lower actuating plate 1626 of the rotating door 1620 so that rotation of the shaft 1644 is transmitted into rotation of the rotating door 1620. Motor 1642 is most preferably an HSI 7.5° per step motor available from Haydon Switch and Instrument, Inc. of Waterbury, Connecticut. The HSI motor is chosen because of its relatively low cost and because the closure assembly 1600 does not require a high torque, robust motor.

20 Door position sensors 1646 and 1648 (preferably slotted optical sensors) are operatively mounted on opposite sides of the door mounting bracket 1636. The sensor 1646 and 1648 cooperate with sensor tabs 1632 and 1630 on the hinge plate 1628 of the door 1620 for

indicating the relative position of the rotating door 1620 and can be configured so as to indicate, for example, a door open and a door closed status.

A door cover element 1612 is secured to the outside of the cylindrical portion 1610 of the housing so as to cover the door mounting bracket 1636 and a portion of the rotating door 1620. The cover element 1612 includes an access opening 1613 aligned with the access opening 1614 of the incubator housing and further includes a receptacle bridge 1615 extending laterally from a bottom edge of the access opening 1613. The receptacle bridge 1615 facilitates the insertion of a receptacle (e.g., an MTU 160) into and withdrawal of the receptacle from the incubator.

While in the target capture and annealing incubator 600, the MTU 160 and test specimens are preferably kept at a temperature of about  $60^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$  for a period of time sufficient to permit hybridization between capture probes and target nucleic acids. Under these conditions, the capture probes will preferably not hybridize with those polynucleotides directly immobilized by the magnetic particles.

Following target capture incubation in the target capture and annealing incubator 600, the MTU 160 is rotated by the incubator carousel to the entrance door 622, also known as the right-side or number one distributor door. The MTU 160 is retrieved from its MTU station 676 within incubator 600 and is then transferred by the right-side transport mechanism 500 to a temperature ramp-down station (not shown) below the specimen ring 250. In the ramp-down station, the MTU temperature is brought down to the level of the next incubator. This ramp-down station that precedes the active temperature and pre-read cool-down incubator 602 is technically a heater, as opposed to a chiller, because the temperature to which the MTU is decreased, about  $40^{\circ}\text{C}$ , is still greater than the ambient analyzer temperature, about  $30^{\circ}\text{C}$ . Accordingly, this ramp-down station preferably uses resistive heating elements, as opposed to a thermoelectric module.

From the ramp-down station, the MTU 160 is transferred by the right-side transfer mechanism 500 into the active temperature and pre-read cool-down incubator 602. The design and operation of the active temperature and pre-read cool-down 602 is similar to that of the target capture and annealing incubator 600, as described above, except that the active temperature and pre-read cool-down incubator 602 incubates at  $40 \pm 1.0^{\circ}\text{C}$ .

In the AT incubator 602, the hybridization conditions are such that the polythymidine tail of the immobilized polynucleotide can hybridize to the polyadenine tail of the capture probe. Provided target nucleic acid has hybridized with the capture probe in the annealing incubator